

### **FORMALITIES**

The Examiner has requested a copy of Japan 09-241351, which was listed in an Information Disclosure Statement (the "IDS") that was filed on June 8, 2001. Please note that the reference was provided to the Examiner with the IDS; however, it was incorrectly labeled as "09-241351", which refers to the "application number" rather than the "publication number." The reference requested was re-filed correctly on August 23, 2001 as Japan 11-087288, which is the "publication number."

The Examiner has indicated by his initials that he has considered "publication number" 11-087288, which corresponds to "application number" 09-241351. Therefore, the Applicants respectfully maintain that no reference needs to be provided and apologize for the confusion.

Secondly, the Applicants bring to the Examiner's attention a Supplemental Information Disclosure Statement that was filed on June 3, 2003 (received June 5, 2003), corresponding to an Office Action in the corresponding case before the Korean Intellectual Property Office. The Applicants respectfully request that the Examiner consider these references as part of his next action and include a duly initialed copy of the Form PTO-1449 with his next correspondence. ✓

### **REMARKS**

Claims 1 through 35 are pending in the subject application. The Examiner asserts that claims 2, 8, and 13-35 have been withdrawn from consideration. Claims 1, 3, 4, 6, 7, and 9-11 stand rejected under 35 USC 102(b). Claims 5 and 12 stand rejected under 35 U.S.C. 103(a). Claim 11 has been amended.

The Applicants appreciate the Examiner's thorough examination of the subject application. However, the Applicants respectfully request reconsideration of the subject application based on the above amendment and the following remarks.

#### TRAVERSE OF ELECTION/RESTRICTION OF CLAIMS

Although, the Examiner asserts that claims 2, 8, and 13-35 have been withdrawn from consideration, in a Response to Office Action filed February 19, 2003, the Applicants elected to prosecute Species I, which includes claims 1-12, with traverse. Thus, the Applicants did not withdraw claims 2 and 8 from consideration.

With respect to claim 2, the Examiner asserts that the means for supplying an "aqueous cleaning agent onto the surface of the object to be cleaned on a side of said scrubbing means" is not disclosed. This is incorrect. Reference numerals 12 and 2, relied on by the Examiner, refer to the "aqueous cleaning agent" and the "ultrasonic wave projection means," respectively, of claim 1. Reference numerals 11 and 3 actually refer, respectively, to the "aqueous cleaning agent" and the "cleaning agent supply means" that forms the subject matter of claim 2. See, e.g., Specification, page 17, lines 25-26 and page 22, lines 6-12. Accordingly, the subject matter of claim 2 is adequately disclosed by the elected species.

Claim 8 depends from claim 2, therefore, for the reason provided above, the Applicants respectfully traverse the exclusion of claims 2 and 8 from consideration.

With respect to species I and II, referring to FIGs. 1 and 2, the two systems only differ in that species I includes transport rollers 4, which are covered by claim 3, and species II includes a rotation mechanism 13, which is covered in claim 13. In FIG. 1, rollers 4 transport a substrate 10 in the direction shown by the arrow. In FIG. 2, the rotation mechanism 13 rotates the substrate 10 about an axis as shown by the arrows. Accordingly, the Applicants respectfully traverse the exclusion of claims 13-

15 because claim 1 is generic to both the rollers 4 as well as the rotation mechanism 13.

### 35 U.S.C. § 102(b) REJECTIONS

The Examiner has rejected claims 1, 3, 7, 9, and 10 under 35 USC § 102(a) as being anticipated by Taiwan published application 341534 ("Taiwan" or the "Taiwan Reference"). Alternatively, the Examiner has rejected claims 1, 3, 4, 6, and 9-11 under 35 USC § 102(b) as being anticipated by Japan published application number 06-005577 ("Japan" or the "Japan Reference"). The Applicants respectfully traverse these rejections based on the above amendment and the following remarks.

The Examiner asserts that the Taiwan reference discloses all of the recited subject matter, referring to FIGs. 2 and 3 thereof. Specifically, per the Examiner, a scrubbing means is shown at reference numerals 2 and/or 44; an ultrasonic wave projection means is shown as reference numerals 23, 25, 29, and/or 31, 34, 36; and a transporting means for transporting an object is shown as reference numerals 31 and/or 32. The Applicants respectfully disagree.

The Applicants maintain that reference numerals 9, 29, and 44 in FIGs. 1, 2, and 3, respectively, of the Taiwan reference correspond to a spray. However, there is nothing to suggest that such a spray provides or performs a scrubbing function as taught by the invention as claimed. Indeed, a scrubbing function is not inherent in spray action, rather conventionally a spray is used to douse or rinse an object. Moreover, it is difficult to envision how the ultrasonic wave function and the scrubbing function can be performed simultaneously at the same location on the object to be cleaned 11, 31, and 32 because one part of the object is sprayed (but not scrubbed) and another part of the object is subject to ultrasonic waves. There is no simultaneous scrubbing and ultrasonic cleaning at the same location.

"Scrubbing" as the term is used and defined in the present invention refers to "brush cleaning", which is not disclosed in or contemplated by the Taiwan reference. Accordingly, the Applicants assert that the invention as claimed is not anticipated by the Taiwan reference because the latter does not have a scrubbing means.

Furthermore, the Applicants believe that reference numerals 5, 23, 25, 34, 36, 38, and 39 appear to be permanent magnets or electromagnets that are used to levitate and position the object 11, 31, 32 and offer that reference numerals 2 and 31 correspond to an ultrasonic wave projection means.

With respect to claims 3, 11, and 13 there is nothing to suggest that the Taiwan reference includes a transport means for transporting objects to be cleaned. The apparent permanent magnets and electromagnets 5, 23, 25, 34, 36, 38, and 39 are conventionally used to levitate and position an object, which the Taiwan figures suggest is the case. Indeed, the object to be cleaned 11, 31, and 32 appears to be inserted into a containment vessel 3, 21, and 30 where it hovers as one part of the object is sprayed (but not scrubbed) and another part of the object is subject to ultrasonic waves. Nothing suggests that the object can be transport in and out of the cleaning area

The Japan reference is described in the specification as a substrate cleaning apparatus that

performs a brush scrubbing cleaning in a cleaning vessel, wherein an overflow vessel storing therein an ultrasonic vibrator is adopted as a cleaning vessel to eliminate the problem of the contamination of the cleaning brush.

Specification, page 6, lines 1-8 (Emphasis added). As such, the substrate remains submerged in the aqueous cleaning agent while it is being scrubbed. With this arrangement, the cleaning brush and substrate are continuously subjected to the aqueous cleaning agent. See, e.g., Id., page 12, lines 8-10. A problem with this

arrangement, however, is that the aqueous cleaning agent is contaminated because particles that are removed from the substrate surface during brush-cleaning can float on the surface of the aqueous cleaning agent or can be suspended therein. These floating and/or suspended particles can be re-deposited on the submerged substrate. See, e.g., Id., page 13, line 8 to page 14, line 3.

By contrast, the invention as claimed provides a device for simultaneously brush cleaning and ultrasonically cleaning a substrate, whereby the upper surface of a substrate 10 is brush-cleaned using a brush roller 1 and simultaneously ultrasonically cleaned by ultrasonic vibrations that are applied to the lower surface of the substrate 10 and that propagate from the lower surface of the substrate 10 to the upper surface of the substrate 10. See, e.g., Specification, page 25 lines 1-10. Moreover, the present invention is continuously shower cleaned using an aqueous cleaning agent 11 from shower nozzles 3 to remove all particulate matter. See, e.g., Id., page 25, line 14 to page 26, line 4.

In short, it is respectfully submitted that, claims 1, 3, 7, 9, and 10 are not anticipated by the Taiwan or Japan references, and further, satisfy all of the requirements of 35 U.S.C. 100, et seq., especially § 102(). Accordingly, the claims are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

#### 35 U.S.C. § 103(a) REJECTIONS

The Examiner has rejected claims 5 and 12 under 35 USC 103(a) as being unpatentable over the Japan reference. The Applicants respectfully traverse these rejections for the reasons provided in greater detail below.

For the same reasons provided above, the Japan reference also cannot make the present invention obvious. Accordingly, the Applicants respectfully assert that, claims 5 and 12 are not made obvious by the Japan reference.

In short, it is respectfully submitted that, claims 5 and 12 are not made obvious any of the cited references, and further, satisfy all of the requirements of 35 U.S.C. 100, et seq., especially § 103(a). Accordingly, claims 5 and 12 are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

The Applicants believe that no additional fee is required for consideration of the within Response. However, if for any reason the fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. **04-1105**.

Respectfully submitted,

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By: 

George W. Hartnell, III  
Reg. No. 42,639

EDWARDS & ANGELL, LLP  
P.O. Box 9169  
Boston, MA 02209  
Tel.: (617) 517-5523  
Customer No. 21874  
332847

**ANNEX TO RESPONSE TO OFFICE ACTION  
INCLUDING MARKED-UP VERSIONS OF AMENDED CLAIMS**

IN THE SPECIFICATION

Please **replace** the first paragraph on page 2, beginning at line 2 and ending at line 15 with the following:

For the precision processing of substrates such as glass substrates for a semiconductor waferwater, a liquid crystal panel, etc., isare generally performed in the following manner. Wires, an insulating film, and a film such as a semiconductor layer, etc., are formed, and the structure as desired is produced by a similar technique to the photographic printing technique, called photolithography. However, when performing precision processing by ~~the~~ photolithography, the problem arises in that particulate contaminant (dust particles) adhering to the surface of the substrate causes defects such as disconnection, shorting, and patterning inferior patterning, which lowers the yield.

Please **replace** the paragraph beginning at line 10 on page 8 and ending at line 1 on page 9 with the following:

1. Firstly, although the cleaning brush and the ultrasonic nozzle are driven simultaneously, becauseas these members are provided on the same surface of the substrate, the brush scrubbing cleaning and ultrasonic cleaning can never be applied to the same part simultaneously. Namely, althoughdespite the cleaning brush and the ultrasonic nozzle are driven simultaneously, the brush scrubbing cleaning and the ultrasonic cleaning can never be applied to the same part on the substrate surface simultaneously. Therefore, an improvement in removing power for the fibrous particles released from the cleaning brush does not lead to an improvement in removing power for the particulate contamination (dust particles). Therefore, the foregoing cleaning

apparatus cannot provide a sufficient level of cleanliness to meet the increasing demand for cleaning of an improved precision (fineness).

Please **replace** the paragraph beginning at line 9 on page 9 and ending at line 21 with the following:

The foregoing cleaning apparatus of Japanese Unexamined Patent Publication No. 86222/1995 also has the following problem. That is, in the structure wherein the ultrasonic nozzle is provided on the side of the cleaning brush, the ultrasonic wave and the aqueous cleaning agent ~~as-supplied from the ultrasonic nozzle~~ have ~~are~~ difficulty ~~to-reaching~~ the part to be brush-cleaned on the surface of the substrate that ~~is as-being~~ disturbed by the cleaning brush. Therefore, the ultrasonic cleaning is specifically applied to the part surrounding the cleaning brush, and is hardly applied to the part to be brush-cleaned on the surface of the substrate.

Please **replace** the paragraph beginning at line 9 on page 10 and ending at line 24 with the following:

Moreover, in the foregoing cleaning apparatus, the aqueous cleaning agent and the ultrasonic wave ~~as-supplied through the ultrasonic nozzle~~ are reflected from the surface of the substrate to be incident on the surface of the cleaning brush. Therefore, in the state where the substrate is not set in the cleaning apparatus, neither of the aqueous cleaning agent ~~nor~~ of ultrasonic wave ~~as-supplied from the ultrasonic nozzle~~ reaches the cleaning brush. Namely, in this structure, the cleaning brush is subjected to the ultrasonic cleaning only in the state where the substrate is set in the cleaning apparatus. Therefore, the particulate contamination (dust particles) ~~as-removed from~~ the cleaning brush may be redeposited onto the surface of the substrate, which in turn contaminates the substrate surface.



Please **r place** the paragraph beginning at line 13 on page 18 and ending at line 1 on page 19 with the following:

As shown in Figure 1, the roll brush 1 includes a cylindrical brush part 1c in which a large number of fabric 1b made of polyamide (nylon) are flocked radially on a surface of a core member 1a, and a rotation drive unit (rotation mechanism) 1d to be connected to the core member 1a for rotating the brush part 1c. The roll brush 1 is arranged such that the core member 1a is positioned ~~parallel~~vertical to the plane of the substrate, and that the fabric 1b makes a contact with the upper surface of the substrate 10. The roll brush 1 scrubs the upper surface (the surface to be cleaned) of the substrate 10 with the brush part 1c that is~~is~~ being rotated by the rotation drive unit 1d, so as to perform a brush-cleaning (brush scrubbing cleaning) of the upper surface of the substrate 10.

Please **replace** the paragraph beginning at line 16 on page 19 and ending at line 8 on page 20 with the following:

The brush part 1c of the roll brush 1 is formed in length slightly longer than the length, in the lengthwise direction of the brush part 1c, of the substrate 10 to be cleaned. Here, it is desirable that the brush part 1c of the roll brush 1 rotates in the direction of scrubbing the substrate 10 in an opposite direction to the transport direction of the substrate 10 ~~so that~~as an improved the effect of cleaning can be improved~~achieved~~. It is desirable that the rotating direction of the brush part 1c of the roll brush 1 be set so as to scrub the substrate 10 in an opposite direction to the transport direction of the substrate 10 ~~so that~~as an improved the effect of cleaning can be improved~~achieved~~. Namely, it is desirable that the rotation direction of the brush part 1c of the roll brush 1 be set in the rotation direction of the transport rollers 4. In this way, the relative speed between the roll brush 1 and the surface of the substrate 10 can be increased, which in turn improves the effect of cleaning.

Please **r plac** the paragraph beginning at line 9 on page 20 and ending at line 15 with the following:

The ultrasonic nozzle 2 is arranged so as to spray the aqueous cleaning agent 12 ~~from its leading end against the center of the roll brush 1 (upwards in the vertical line).~~ The ultrasonic nozzle 2 stores therein an ultrasonic vibrator 2a for applying ultrasonic wave onto the center of the roll brush 1 ~~(upwards along the vertical line).~~

Please **replace** the paragraph beginning at line 5 on page 23 and ending at line 5 on page 24 with the following:

The transport rollers 4 transport the substrate 10 at a constant rate along the horizontal surface in a direction perpendicular to the axis of rotation of ~~vertical to the~~ core member 1a of the roll brush 1 while rotating on the lower surface of the substrate 10. With this transportation, the entire surface of the substrate 10 can be cleaned entirely without moving the roll brush 1 ~~or~~ the ultrasonic nozzle 2 in the transport direction of the substrate 10. In this case, it is not necessary to move the roll brush 1, and, as for the ultrasonic nozzle 2, it is only required to move it in a direction that is perpendicular to the ~~vertical to the~~ transport direction of the substrate 10, ~~i.e., in the horizontal direction.~~ Therefore, a complicated moving mechanism such as a robot arm for moving the roll brush 1 and the ultrasonic nozzle 2 interlocking with each other in the direction as desired can be omitted, thereby realizing a simplified moving structure. Moreover, it is arranged such that the transport rollers 4 can convey a plurality of substrates 10 between the roll brush 1 and the ultrasonic nozzle 2 successively, so that a plurality of substrates 10 can be cleaned successively. Here, it may be arranged so as to transport the substrate 10 by independently performing the step of transporting it into the space formed between the roll brush 1 and the ultrasonic nozzle 2 and the step of transporting it out of the space.

Please **r plac** the paragraph beginning at line 24 on page 26 and ending at line 8 on page 25 with the following:

Here, the following problem is to be considered. The longer ~~is~~ the operating time of the cleaning apparatus, the more ~~is~~ likely it is that contaminants as collected by the cleaning brush are stored therein, which ~~causes~~ causes the contamination of the substrate surface. To prevent the foregoing problem, in the conventional cleaning apparatus, a periodic maintenance is needed for cleaning the cleaning brush, for which it is generally required to stop the operation of the cleaning apparatus and perform troublesome operations.

Please **replace** the paragraph beginning at line 24 on page 28 and ending at line 10 on page 25 with the following:

In the present embodiment, the roll brush 1 is adopted as the cleaning brush for cleaning the substrate 10. However, the cleaning brush of the present invention is not limited to the roll brush, and for example, in ~~lieu~~ replace of the roll brush 1, a disk brush 19 (disk-shaped brush) having a rotation mechanism ~~for~~ rotating the disk brush 19 about the vertical rotation axis, which is to say rotation in a plane parallel to the plane of the substrate 10, may be adopted. See, e.g., FIG. 7. In the case of adopting the disk brush 19, it is preferable that the horizontal moving mechanism be provided for moving the disk brush 19 in the horizontal direction along the surface of the substrate 10 so that the entire surface of the substrate 10 can be cleaned.

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Please **replace** the paragraph beginning at line 11 on page ~~25~~ <sup>29</sup> and ending at line 23 with the following:

In the present embodiment, the transport rollers 4 are adopted for transporting the substrate 10. However, the transport means of the present invention is not particularly limited to the transport rollers 4, and for example, a belt conveyer 15 may

be adopted. See, e.g., FIG. 7. However, in order to effectively clean the upper surface of the substrate 10, it is preferable that the transport means for transporting the substrate 10 be arranged so as to transport the substrate 10 in a direction parallel to the upper surface (surface to be cleaned) of the substrate 10 between the roll brush 1 and the ultrasonic nozzle 2, i.e., in the horizontal direction.

Please **add** the following paragraph after the paragraph beginning at line 12 and ending at line 14 and before the DESCRIPTION OF THE EMBODIMENTS:

Figure 7 is a side view illustrating of a cleaning apparatus in accordance with another embodiment of the present invention.

#### IN THE CLAIMS

Please **amend** the claims as follows:

11. (Amended) The cleaning apparatus as set forth in claim 1, wherein:  
said aqueous cleaning agent is at least one of pure water, superpure water, hydrogen water, ozone water, dilute hydrofluoric acid, and~~or~~ aqueous surface active agent.